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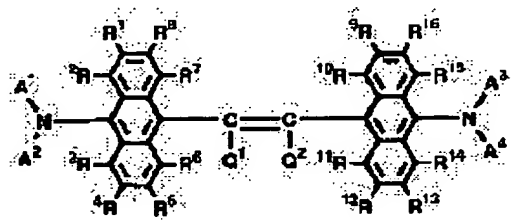
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(54) ORGANIC ELECTROLUMINESCENT ELEMENT MATERIAL AND ORGANIC ELECTROLUMINESCENT ELEMENT USING IT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an organic EL element having high luminous efficiency in a spectrum region of yellow to red and long luminescent life, by using an organic luminescent element material having a specific structure.

SOLUTION: An element material represented by the formula is used. In the formula, A1-A4 independently represent a substituted or unsubstituted alkyl group, a monocyclic group or a condensation polycyclic group, A1 and A2, and A3 and A4 represent a condensation polycyclic group using a nitrogen atom as a coupling means; Q1, Q2 independently represent a hydrogen atom, cyano group, substituted or unsubstituted alkyl group, monocyclic group or a condensation polycyclic group; R1-R16 independently represent a hydrogen atom, halogen atom, cyano group, nitro group, substituted or unsubstituted alkyl group, alkoxy group, aryloxy group, alkylthio group, arylthio group, monocyclic group, condensation polycyclic group, amino group, alkylamino group or arylamino group.



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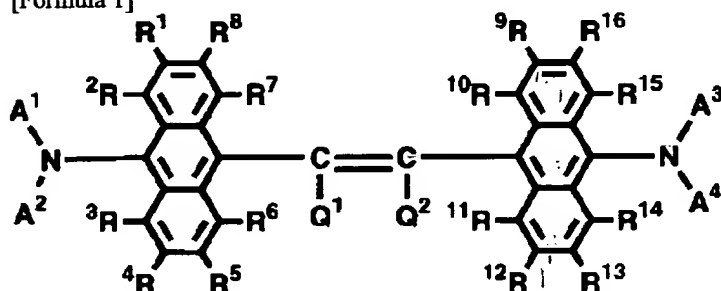
CLAIMS

[Claim(s)]

[Claim 1] Organic electroluminescent-element material shown by the following general formula [1].

General formula [1]

[Formula 1]

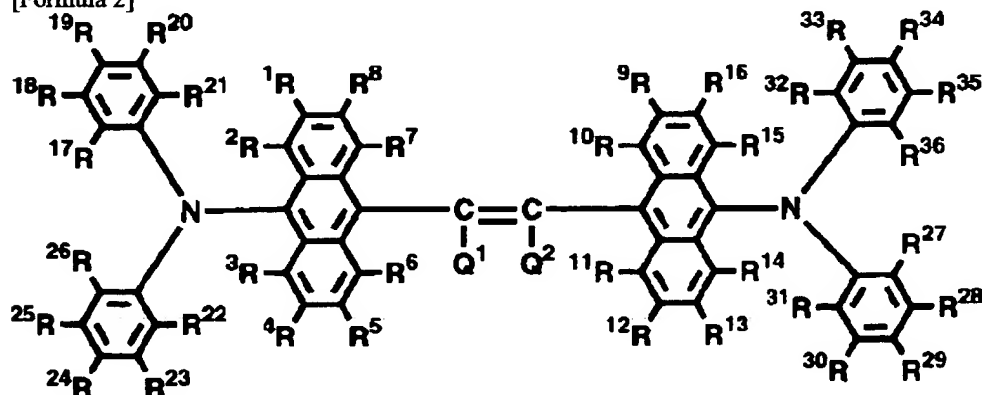


A1 -A4 expresses independently the condensation polycyclic basis which the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / substitution, or /, substitution, or /, substitution, or] or A1 and A2, and A3 and A4 are united, and uses a nitrogen atom as a joint hand among [formula, respectively. Q1 and Q2 The condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or] is expressed independently, respectively. Independently R1 -R16, respectively A hydrogen atom, a halogen atom, a cyano group, The alkoxy group which is not replaced [the alkyl group which is not replaced / a nitro group, substitution, or /, substitution, or], The alkyl thio machine which is not replaced [the aryloxy group which is not replaced / substitution or /, substitution, or], The monocycle machine which is not replaced [the aryl thio machine which is not replaced / substitution or / substitution, or], The arylamino machine which is not replaced [the alkylamino machine which is not replaced / the amino group which is not replaced / the condensation polycyclic basis which is not replaced / substitution or /, substitution, or /, substitution, or /, substitution, or] is expressed (it may join together mutually by the adjoining bases, respectively, and a new ring may be formed.).]

[Claim 2] Organic electroluminescent-element material shown by the following general formula [2].

General formula [2]

[Formula 2]



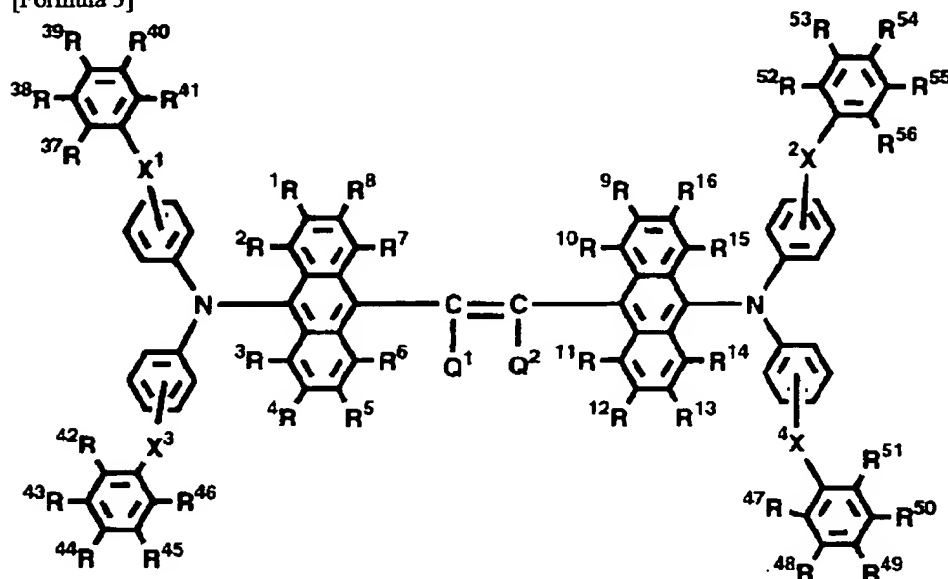
Q1 and Q2 express independently the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or] among [formula, respectively. Independently R1 -R36, respectively A hydrogen atom, a halogen atom, a cyano group, The alkoxy group which is not replaced [the alkyl group which is not replaced / a nitro group, substitution, or /, substitution, or], The alkyl thio machine which is not replaced [the aryloxy group which is not replaced / substitution or /, substitution, or], The

monocycle machine which is not replaced [the aryl thio machine which is not replaced / substitution, or /, substitution, or], The arylamino machine which is not replaced [the alkylamino machine which is not replaced / the amino group which is not replaced / the condensation polycyclic basis which is not replaced / substitution, or /, substitution, or /, substitution, or /, substitution, or] is expressed (it may join together mutually by the adjoining bases, respectively, and a new ring may be formed.).]

[Claim 3] Organic electroluminescent-element material shown by the following general formula [3].

General formula [3]

[Formula 3]

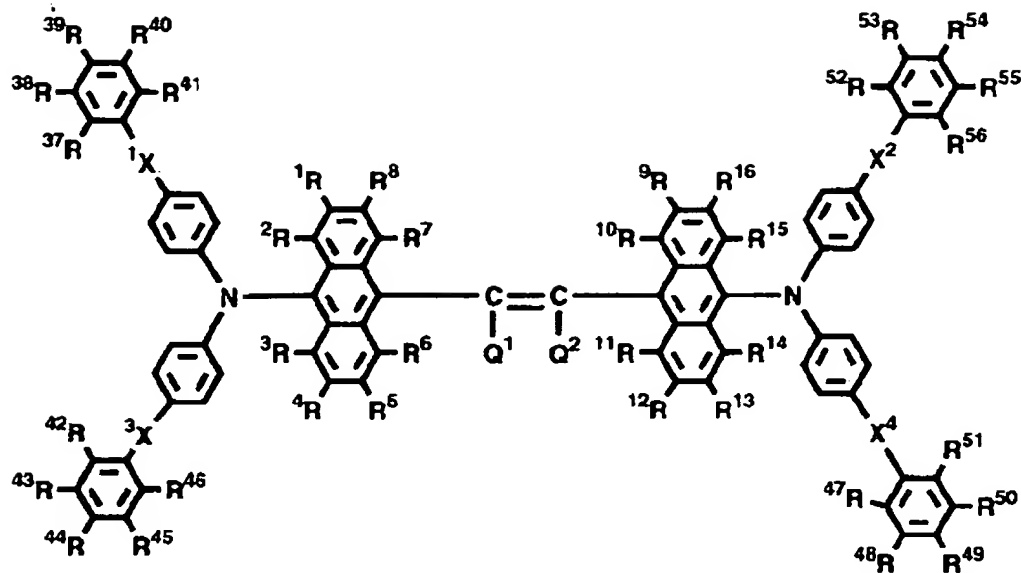


Q1 and Q2 express independently the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or] among [formula, respectively. Independently R1 -R16, and R37-R56, respectively A hydrogen atom, The alkyl group which is not replaced [a halogen atom, a cyano group a nitro group, substitution, or], The aryloxy group which is not replaced [the alkoxy group which is not replaced / substitution, or /, substitution, or], The aryl thio machine which is not replaced [the alkyl thio machine which is not replaced / substitution, or /, substitution, or], The arylamino machine which is not replaced [the alkylamino machine which is not replaced / the amino group which is not replaced / the condensation polycyclic basis which is not replaced / the monocycle machine which is not replaced / substitution, or /, substitution, or /, substitution, or /, substitution, or] is expressed (it may join together by the basis comrade who adjoined, and a new ring may be formed.). X1-X4 Independently, respectively O, S, C=O, C**C, and CZ1 =CZ2, The aliphatic ring residue which is not replaced [the alkylene machine which is not replaced / SO2, x-O(CH2)-(CH2) y, substitution, or /, substitution, or] is expressed (Z1 and Z2). the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or] is expressed independently, respectively, and although x and y express the positive integer of 0-20, respectively, x+y=0 and a bird clapper do not have them .]

[Claim 4] Organic electroluminescent-element material shown by the following general formula [4].

General formula [4]

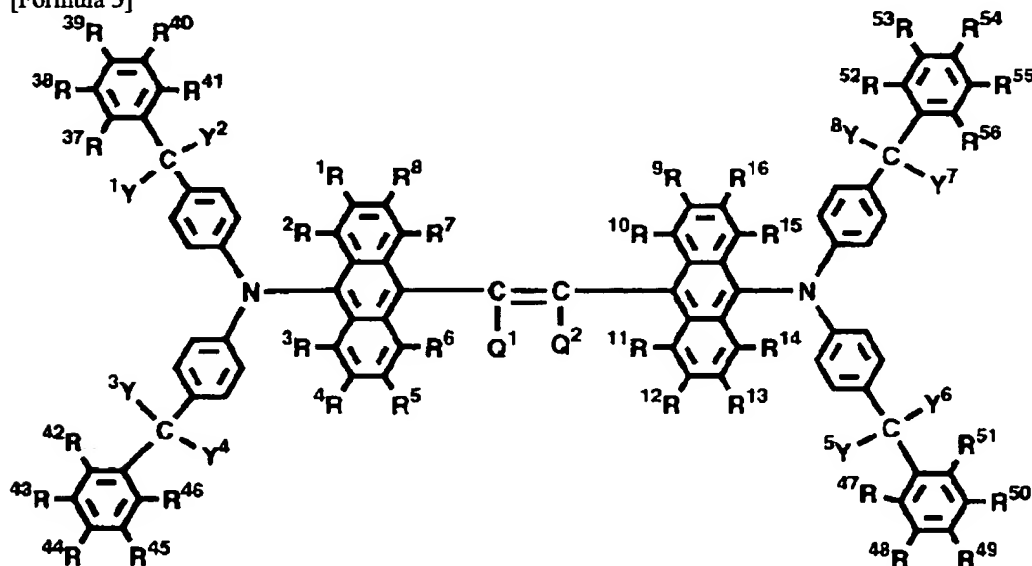
[Formula 4]



Q1 and Q2 express independently the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the condensation polycyclic basis substitution which is not replaced / the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or /, substitution, or /] among [formula, respectively. Independently R1 -R16, and R37-R56, respectively A hydrogen atom, The alkyl group which is not replaced [a halogen atom, a cyano group a nitro group, substitution, or /, substitution, or /, substitution, or /, substitution, or /] is expressed (it may join together by the basis comrade who adjoined, and a new ring may be formed.). X1 -X4 Independently, respectively O, S, C=O, C**C, and CZ1 =CZ2, The aliphatic ring residue which is not replaced [the alkylene machine which is not replaced / SO2, x-O(CH2)-(CH2) y, substitution, or /, substitution, or /, substitution, or /, substitution, or /] is expressed (Z1 and Z2). independently, the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom a cyano group, substitution, or /, substitution, or /, substitution, or /, substitution, or /] is expressed, and although x and y express the positive integer of 0-20, respectively, x+y=0 and a bird clapper do not have them, respectively] [Claim 5] Organic electroluminescent-element material shown by the following general formula [5].

General formula [5]

[Formula 5]



Q1 and Q2 express independently the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or /, substitution, or /] among [formula, respectively. Independently R1 -R16, and R37-R56, respectively A hydrogen atom, The alkyl group which

is not replaced [a halogen atom, a cyano group a nitro group, substitution, or], The aryloxy group which is not replaced [the alkoxy group which is not replaced / substitution or /, substitution, or], The aryl thio machine which is not replaced [the alkyl thio machine which is not replaced / substitution or /, substitution, or], The amino group which is not replaced [the condensation polycyclic basis which is not replaced / the monocycle machine which is not replaced / substitution or /, substitution, or /, substitution, or], The arylamino machine which is not replaced [the alkylamino machine which is not replaced / substitution or /, substitution, or] is expressed (it may join together by the basis comrade who adjoined, and R1 -R16, or R37-R56 may form a new ring.) . Y1 -Y8 The condensation polycyclic basis which is not replaced [the monocycle machine of the carbon numbers 6-16 which are not replaced / the alkyl group of the carbon numbers 1-20 which are not replaced / substitution or /, substitution, or /, substitution, or] is expressed.]

[Claim 6] the organic electroluminescent element in which the organic compound thin film of two or more layers which contains a luminous layer in inter-electrode [of a couple] was formed -- setting -- at least -- a monostromatic -- a claim -- the organic electroluminescent element which is the layer which contains an organic electroluminescent-element material of a publication one to 5 either

[Claim 7] the organic electroluminescent element in which the organic compound thin film of two or more layers which contains a luminous layer in inter-electrode [of a couple] was formed -- setting -- a luminous layer -- a claim -- the organic electroluminescent element which is the layer which contains an organic electroluminescent-element material of a publication one to 5 either

[Claim 8] a luminous layer -- from host material and doping material -- becoming -- this doping material -- a claim -- the organic electroluminescent element according to claim 8 which is an organic electroluminescent-element material of a publication one to 5 either

[Claim 9] Organic electroluminescent element according to claim 7 or 8 characterized by forming a 1-4-layer electron-injection layer between a luminous layer and an anode plate.

[Claim 10] Organic electroluminescent element according to claim 9 characterized by forming a 1-4-layer hole-injection layer between a luminous layer and cathode.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the organic electroluminescence (EL) element used for the flat-surface light source or a display.

[0002]

[Description of the Prior Art] Promising ** of the use as a large area full color display device with a cheap solid-state luminescence type is carried out, and, as for the EL element which used the organic substance, many development is performed. Generally EL consists of counterelectrodes of the couple the luminous layer and whose layer of this were pinched. When electric field are impressed between two electrodes, an electron is poured in from a cathode side and, as for luminescence, an electron hole is poured in from an anode plate side. Furthermore, in case this electron recombines with an electron hole in a luminous layer and an energy level returns from a conduction band to a valence band, it is the phenomenon which emits energy as a light.

[0003] Compared with the inorganic EL element, the conventional organic EL element had high driver voltage, and luminescence brightness and its luminous efficiency were also low. Moreover, property degradation had not resulted in utilization remarkably, either. In recent years, the organic EL element which carried out the laminating of the thin film containing the organic compound with the high fluorescence quantum efficiency which emits light by the low battery not more than 10V is reported, and the interest is attracted (refer to applied FIJIKUSU Letters, 51 volumes, 913 pages, and 1987). By this method, the fluorescent substance layer and the amine system compound were used for the hole-injection layer for the metal chelate complex, green luminescence of high brightness has been obtained, 100 cd/m² and the maximum luminous efficiency attain 1.5 lm/W by the direct current voltage of 6-7V, and brightness has a performance near a practical use field. However, although the organic EL element by present is set green by improvement of composition and luminescence intensity is improved, it does not have luminescence brightness still sufficient in the wavelength range of yellow - red.

[0004] In order to obtain luminescence of the wavelength range of yellow - red from an organic EL element, the technology which dopes guest material into host material and produces a luminous layer into it is indicated. For example, although the organic EL element (refer to Journal of Applied Physics, 65 volumes, 3610 pages, and 1989) which doped coumarin coloring matter or DCM coloring matter as a fluorescence nature guest material into host material was in the luminous layer about the tris (8-hydroxyquinoline) aluminum complex, the luminous efficiency of these organic EL elements was not enough. Moreover, in the luminous layer, in the tris (8-hydroxyquinoline) aluminum complex, a phthalocyanine compound is doped into host material and the organic EL element of red luminescence is indicated (publication-number 07-No. 288284 official report). However, the initial luminous efficiency of these organic EL elements was not yet enough, and its degradation at the time of making light emit continuously was remarkable, and it had a practically big problem.

[0005]

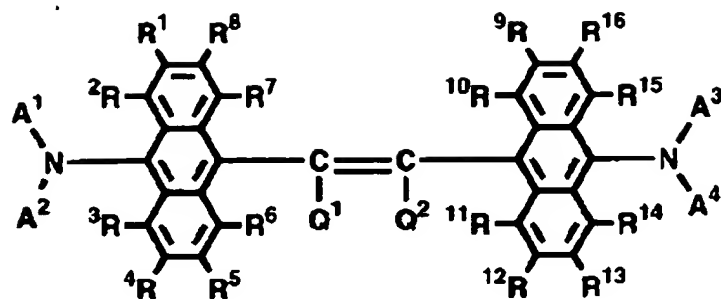
[Problem(s) to be Solved by the Invention] The purpose of this invention has high luminous efficiency at the spectral region of yellow - red, and is in offer of the organic EL element which was excellent in the luminescence life. As a result of this invention persons' inquiring wholeheartedly, luminous efficiency was high at the spectral region of the yellow of the organic EL element which used at least a kind of organic EL-element material of the compound shown by general formula [1] - [5] for the monostromatic - red, and it found out that the luminescence life was also excellent and resulted in this invention.

[0006]

[Means for Solving the Problem] That is, this invention is an organic electroluminescent-element material shown by the following general formula [1].

General formula [1]

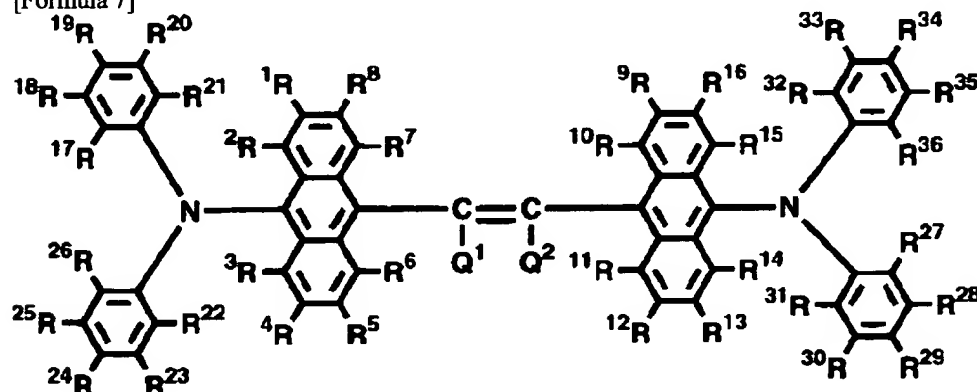
[Formula 6]



A1 -A4 expresses independently the condensation polycyclic basis which the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / substitution or /, substitution, or /, substitution, or] or A1 and A2, and A3 and A4 are united, and uses a nitrogen atom as a joint hand among [formula, respectively. Q1 and Q2 The condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or] is expressed independently, respectively. Independently R1 -R16, respectively A hydrogen atom, a halogen atom, a cyano group, The alkoxy group which is not replaced [the alkyl group which is not replaced / a nitro group, substitution, or /, substitution, or], The alkyl thio machine which is not replaced [the aryloxy group which is not replaced / substitution or /, substitution, or], The monocycle machine which is not replaced [the aryl thio machine which is not replaced / substitution or / substitution, or], The arylamino machine which is not replaced [the alkylamino machine which is not replaced / the amino group which is not replaced / the condensation polycyclic basis which is not replaced / substitution or /, substitution, or /, substitution, or /, substitution, or] is expressed (it may join together mutually by the adjoining bases, respectively, and a new ring may be formed.).]
 [0007] Furthermore, this invention is an organic electroluminescent-element material shown by the following general formula [2].

General formula [2]

[Formula 7]



Q1 and Q2 express independently the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or] among [formula, respectively. Independently R1 -R36, respectively A hydrogen atom, a halogen atom, a cyano group, The alkoxy group which is not replaced [the alkyl group which is not replaced / a nitro group, substitution, or /, substitution, or], The alkyl thio machine which is not replaced [the aryloxy group which is not replaced / substitution or /, substitution, or], The monocycle machine which is not replaced [the aryl thio machine which is not replaced / substitution or / substitution, or], The arylamino machine which is not replaced [the alkylamino machine which is not replaced / the amino group which is not replaced / the condensation polycyclic basis which is not replaced / substitution or /, substitution, or /, substitution, or /, substitution, or] is expressed (it may join together mutually by the adjoining bases, respectively, and a new ring may be formed.).]
 [0008] Furthermore, this invention is an organic electroluminescent-element material shown by the following general formula [3].

General formula [3]

[Formula 8]

[0015] Furthermore, this invention is organic electroluminescent element characterized by forming a 1-4-layer hole-injection layer between a luminous layer and cathode.

[0016]

[Embodiments of the Invention] General formula [1] R1 -R56 of a compound expressed with - [5] independently, respectively The alkyl group which is not replaced [a hydrogen atom, a halogen atom a cyano group, a nitro group, substitution, or], The aryloxy group which is not replaced [the alkoxy group which is not replaced / substitution or /, substitution, or], The aryl thio machine which is not replaced [the alkyl thio machine which is not replaced / substitution or /, substitution, or], The arylamino machine which is not replaced [the alkylamino machine which is not replaced / the amino group which is not replaced / the condensation polycyclic basis which is not replaced / the monocycle machine which is not replaced / the cycloalkyl machine which is not replaced / substitution or /, substitution, or /, substitution, or /, substitution, or /, substitution, or /, substitution, or / is expressed.

[0017] As an example of the halogen atom of R1 -R56 of a compound expressed with general formula [1] - [5] in this invention There are chlorine, a bromine, iodine, and a fluorine. as an example of an alkyl group A methyl group, an ethyl group, a propyl group, a butyl, a sec-butyl, a tert-butyl, There are a pentyl machine, a hexyl machine, a heptyl machine, an octyl machine, a stearyl machine, a TORIKURORO methyl group, etc., and there are a cyclopentane ring, a cyclohexane ring, etc. as an example of cycloalkyl.

[0018] As an example of the alkoxy group of R1 -R56 of a compound expressed with general formula [1] - [5] in this invention A methoxy machine, an ethoxy basis, an n-butoxy machine, a tert-butoxy machine, A TORIKURORO methoxy machine, a trifluoroethoxy machine, a pentafluoro propoxy group, A 2, 2, 3, and 3-tetrafluoro propoxy group, 1, 1, 1, 3 and 3, and 3-hexafluoro-2-propoxy group, There is a 6-(perfluoro ethyl) hexyloxy machine etc. as an example of an aryloxy group There are a phenoxy machine, p-nitroglycerine phenoxy machine, a p-tert-butyl phenoxy machine, 3-fluoro phenoxy machine, a pentafluorophenyl machine, a 3-trifluoromethyl phenoxy machine, etc.

[0019] The example of the alkyl thio machine of R1 -R56 of a compound expressed with general formula [1] - [5] in this invention, There are a methylthio machine, an ethyl thio machine, a tert-butyl thio machine, a hexyl thio machine, an octyl thio machine, a trifluoromethyl thio machine, etc. The example of an aryl thio machine, There are a phenylthio machine, p-nitroglycerine phenylthio machine, a p-tert-butyl phenylthio machine, 3-fluoro phenylthio machine, a pentafluoro phenylthio machine, a 3-trifluoromethyl phenylthio machine, etc.

[0020] As a monocycle machine of R1 -R56 of the compound expressed with general formula [1] - [5] in this invention, there are a phenyl group, a thionyl machine, a thio phenyl group, a furanyl machine, a pyrrolyl machine, an imidazolyl machine, a pyrazolyl machine, a pyridyl machine, a pyrazinyl machine, a pyrimidinyl group, a pilus DAJINIRU machine, an oxazolyl machine, a thiazolyl machine, an oxadiazolyl machine, a thiadiazolyl machine, an IMIDAJIAZORIRU machine, etc.

[0021] As a condensation polycyclic basis of R1 -R56 of the compound expressed with general formula [1] - [5] in this invention A naphthyl group, an anthryl machine, a phenan tolyl group, a fluorenyl group, a pyrenyl machine, The Indore machine, a pudding machine, a quinoline machine, an isoquinoline machine, a SHINORIN machine, a quinoxaline machine, a benzo quinoline machine, and full -- me -- non -- a basis and a carbazol group -- An oxazole machine, an OKISA diazole machine, a thiazole machine, a thiadiazole machine, A triazole machine, an imidazole group, a benzo oxazole machine, a benzothiazole machine, A benzotriazol machine, a benzimidazole machine, a screw benzo oxazole machine, There are a screw benzothiazole machine, a screw benzimidazole machine, an anthrone machine, a dibenzofuran machine, a dibenzo thiophene machine, an anthraquinone machine, an acridone machine, a phenothiazin machine, a pyrrolidine machine, a dioxane machine, a morpholine machine, etc.

[0022] As an example of the amino group of R1 -R56 of a compound expressed with general formula [1] - [5] in this invention The amino group, the screw (acetoxymethyl) amino group, the screw (acetoxylethyl) amino group, There are a screw acetoxymethyl amino group, a screw (acetoxymethyl) amino group, etc. As an example of an alkylamino machine, an ethylamino machine, a diethylamino machine, There are a dipropylamino machine, a dibutylamino machine, a benzylamino machine, a benzylamino machine, etc. as an example of an arylamino machine There are a phenylamino machine, an amino group (3-methylphenyl), an amino group (4-methylphenyl), etc. as an example of a phenylamino machine A phenylamino machine, a phenyl methylamino machine, a diphenylamino machine, There are a ditolylamino machine, the JIBIFE nil amino group, the JI (4-methyl biphenyl) amino group, a JI (3-methylphenyl) amino group, a JI (4-methylphenyl) amino group, a naphthyl phenylamino machine, a screw [4-(alpha and alpha'-dimethyl benzyl) phenyl] amino group, etc.

[0023] Moreover, by the bases which R1 -R56 adjoin, it may join together mutually, respectively and saturation, such as a phenyl ring, a naphthyl ring, an anthryl ring, a pyrenyl ring, a carbazole ring, a benzo pyranly ring, and a cyclohexyl ring, or an unsaturation ring may be formed.

[0024] General formula [1] Q1 of the compound of - [5], and Q2 The condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom, a cyano group, substitution, or /, substitution, or /, substitution, or] is expressed independently, respectively. The alkyl group described by R1 -R56 of the above [the example of an alkyl group, a monocycle machine, and a condensation polycyclic basis], a monocycle machine, and a condensation polycyclic basis are mentioned.

[0025] A1 -A4 of the compound of a general formula [1] It is the condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / substitution or /, substitution, or /, substitution, or] or A1 independently, respectively. A2 and A3 A4 The condensation polycyclic basis which is united and uses a nitrogen atom

as a joint hand is expressed. The alkyl group described by R1 -R56 of the above [the example of an alkyl group, a monocycle machine, and a condensation polycyclic basis], a monocycle machine, and a condensation polycyclic basis are mentioned.

[0026] A1 of the compound of a general formula [1] A2 and A3 A4 You may form the condensation polycyclic basis which is united and contains a nitrogen atom like a carbazol group, a phenothiazin machine, and an acridone machine.

[0027] X1 -X4 of a compound expressed with the general formula [3] in this invention, and [4] The aliphatic ring residue which is not replaced [the alkylene machine which is not replaced / O, S, C=O, CZ1 =CZ2, C**C, SO2, x-O(CH2)-(CH2) y, substitution, or /, substitution, or /, substitution, or] is expressed independently, respectively. Here, although x and y express the positive integer of 0-20, respectively, x+y=0 and a bird clapper do not have them. Moreover, Z1 And Z2 The condensation polycyclic basis which is not replaced [the monocycle machine which is not replaced / the alkyl group which is not replaced / a hydrogen atom a cyano group, substitution, or /, substitution, or /, substitution, or] is expressed independently, respectively. The alkyl group described by R1 -R56 of the above [the example of an alkyl group, a monocycle machine, and a condensation polycyclic basis], a monocycle machine, and a condensation polycyclic basis are mentioned. As an alkylene machine which is not replaced [substitution or /], the divalent residue of the aliphatic ring of the carbon numbers 5-7, such as a cyclopentyl ring, a cyclohexyl ring, a methyl cyclohexyl ring, and a cycloheptyl ring, is mentioned as an aliphatic ring residue which is not replaced [the alkylene machine of carbon numbers 1-20 or its substitution product, substitution, or]. X1 -X4 There is a substituent shown by R1 -R56 as a substituent of a substitution alkylene machine or a substitution aliphatic ring residue. X1 -X4 As for a thing desirable as a substitution alkylene machine, 2-phenyl isopropanal pyrene machine, dichloro methylene-group, difluoro methylene-group, benzylene group, alpha-phenoxy benzylene group, alpha, and alpha'-dimethyl benzylene group, alpha-benzyloxy benzylene group, etc. are mentioned.

[0028] Y1 -Y8 of a compound expressed with the general formula [5] in this invention The monocycle machine of the carbon numbers 6-16 which are not replaced [the alkyl group of the carbon numbers 1-20 which are not replaced / substitution or /, substitution, or] and a condensation polycyclic basis are expressed. The alkyl group described by R1 -R56 of the above [the example of an alkyl group, a monocycle machine, and a condensation polycyclic basis], a monocycle machine, and a condensation polycyclic basis are mentioned.

[0029] Q1 in this invention, and Q2 An alkyl group, a monocycle machine, a condensation polycyclic basis, And the alkyl group of A1 -A 4, a monocycle machine, a condensation polycyclic basis, and A1 A2, A3 A4 The condensation polycyclic basis which is united and uses a nitrogen atom as a joint hand, And the alkyl group shown by R1 -R56, an alkoxy group, an aryloxy group, An alkyl thio machine, an aryl thio machine, a cycloalkyl machine, a monocycle machine, a condensation polycyclic basis, The amino group, an alkylamino machine, an arylamino machine, and X1 -X2 Alkylene machine, And Y1 -Y8 An alkyl group, a monocycle machine, a condensation polycyclic basis, and Z1 And Z2 There is a substituent shown below as an example of representation of the basis which may be replaced by the alkyl group, the monocycle machine, and the condensation polycyclic basis.

[0030] As a halogen atom, they are chlorine, a bromine, iodine, and a fluorine. As an alkyl group, there are a methyl group, an ethyl group, a propyl group, a butyl, a sec-butyl, a tert-butyl, a pentyl machine, a hexyl machine, a heptyl machine, an octyl machine, a stearyl machine, a TORIKURORO methyl group, etc., and there is a cyclopentane ring, cyclohexane ring, 1, 3-cyclohexa dienyl machine, 2-cyclopentene-1-IRU machine, 2, and 4-cyclopentadiene-1-IRIDENIRU machine etc. as cycloalkyl.

[0031] As an alkoxy group, a methoxy machine, an ethoxy basis, an n-butoxy machine, A tert-butoxy machine, a TORIKURORO methoxy machine, a trifluoroethoxy machine, A pentafluoro propoxy group, 2, 2 and 3, 3-tetrafluoro propoxy group, There are a 1, 1, 1, 3, 3, and 3-hexafluoro-2-propoxy group, a 6-(perfluoro ethyl) hexyloxy machine, etc. as an aryloxy group There are a phenoxy machine, p-nitroglycerine phenoxy machine, a p-tert-butyl phenoxy machine, 3-fluoro phenoxy machine, a pentafluorophenyl machine, a 3-trifluoromethyl phenoxy machine, etc.

[0032] As an alkyl thio machine, there are a methylthio machine, an ethyl thio machine, a tert-butyl thio machine, a hexyl thio machine, an octyl thio machine, a trifluoromethyl thio machine, etc., and there are a phenylthio machine, p-nitroglycerine phenylthio machine, a p-tert-butyl phenylthio machine, 3-fluoro phenylthio machine, a pentafluoro phenylthio machine, a 3-trifluoromethyl phenylthio machine, etc. as an aryl thio machine.

[0033] As an aryl group, there are a phenyl group, a biphenyl machine, a terphenyl machine, a naphthyl group, an anthryl machine, a phenan tolyl group, a fluorenyl group, a pyrenyl machine, etc. as a heterocycle machine A pyrrole machine, a pyrroline machine, a pyrazole machine, a pyrazoline machine, an imidazole group, A triazole machine, a pyridine machine, a pyridazine machine, a pyrimidine machine, a pyrazine machine, A triazine machine, the Indore machine, a pudding machine, a quinoline machine, an isoquinoline machine, a SHINORIN machine, a quinoxaline machine, a benzo quinoline machine, and full -- me -- non -- a basis -- A carbazol group, an oxazole machine, an OKISA diazole machine, a thiazole machine, A thiadiazole machine, a triazole machine, an imidazole group, a benzo oxazole machine, A benzothiazole machine, a benzotriazol machine, a benzimidazole machine, There are a screw benzo oxazole machine, a screw benzothiazole machine, a screw benzimidazole machine, an anthrone machine, a dibenzofuran machine, a dibenzo thiophene machine, an anthraquinone machine, an acridone machine, a phenothiazin machine, a pyrrolidine machine, a dioxane machine, a morpholine machine, etc.

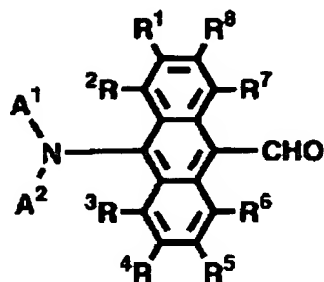
[0034] As an amino group, the amino group, the screw (acetoxymethyl) amino group, The screw (acetoxymethyl) amino group, the screw acetoxymethyl propyl amino group, There is a screw (acetoxymethyl) amino group etc. as an example of an alkylamino machine An ethylamino machine, There are a diethylamino machine, a dipropylamino machine, a dibutylamino machine, a benzylamino machine dibenzylamino machine, etc. as an example of an arylamino machine A phenylamino machine, the amino group (3-methylphenyl), the amino group (4-methylphenyl), A phenyl methylamino machine, a diphenylamino machine, the screw

(4-phenoxyphenyl) amino group, The screw (4-biphenyl) amino group, the screw [4-(4-tolyl) phenyl] amino group, There are a screw (3-methylphenyl) amino group, a screw (4-methylphenyl) amino group, a naphthyl phenylamino machine, a screw [4-(alpha and alpha'-dimethyl benzyl) phenyl] amino group, etc.

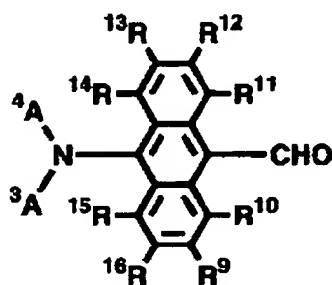
[0035] In this invention, the compound expressed with general formula [1] - [5] is compoundable by the following methods, for example. It can obtain by heating the following general formula [6] and a general formula [7] in a tetrahydrofuran under a titanium tetrachloride and zinc powder existence. Although the example of representation of the compound of this invention is concretely illustrated to Table 1 below, this invention is not limited to the following examples of representation.

[Formula 11]

一般式 [6]



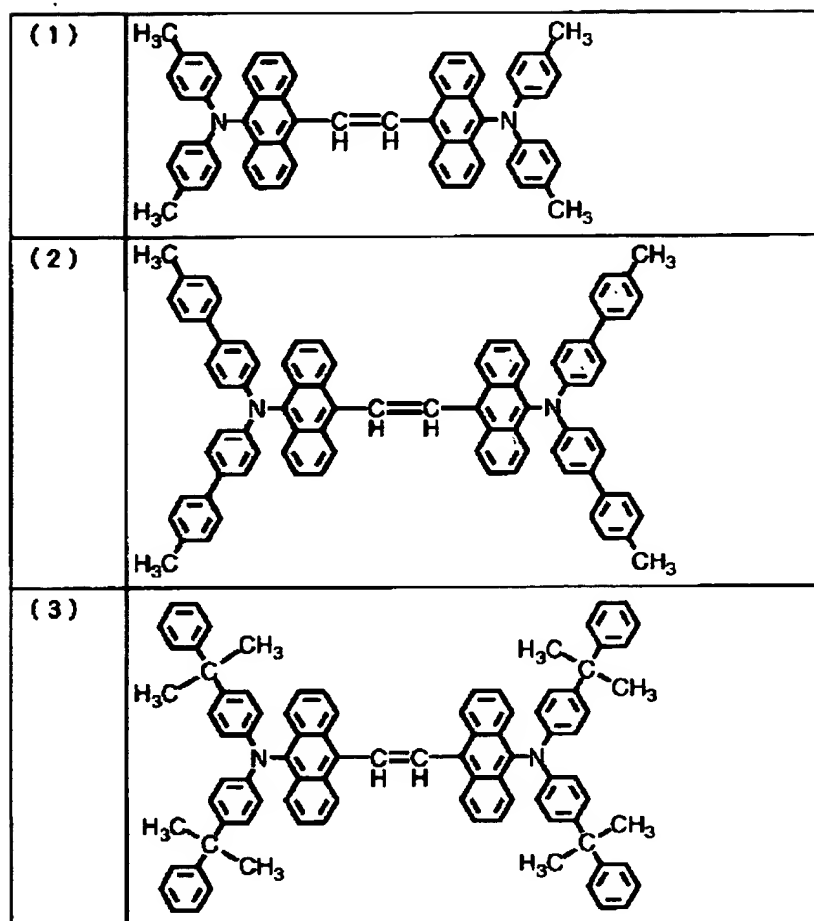
一般式 [7]



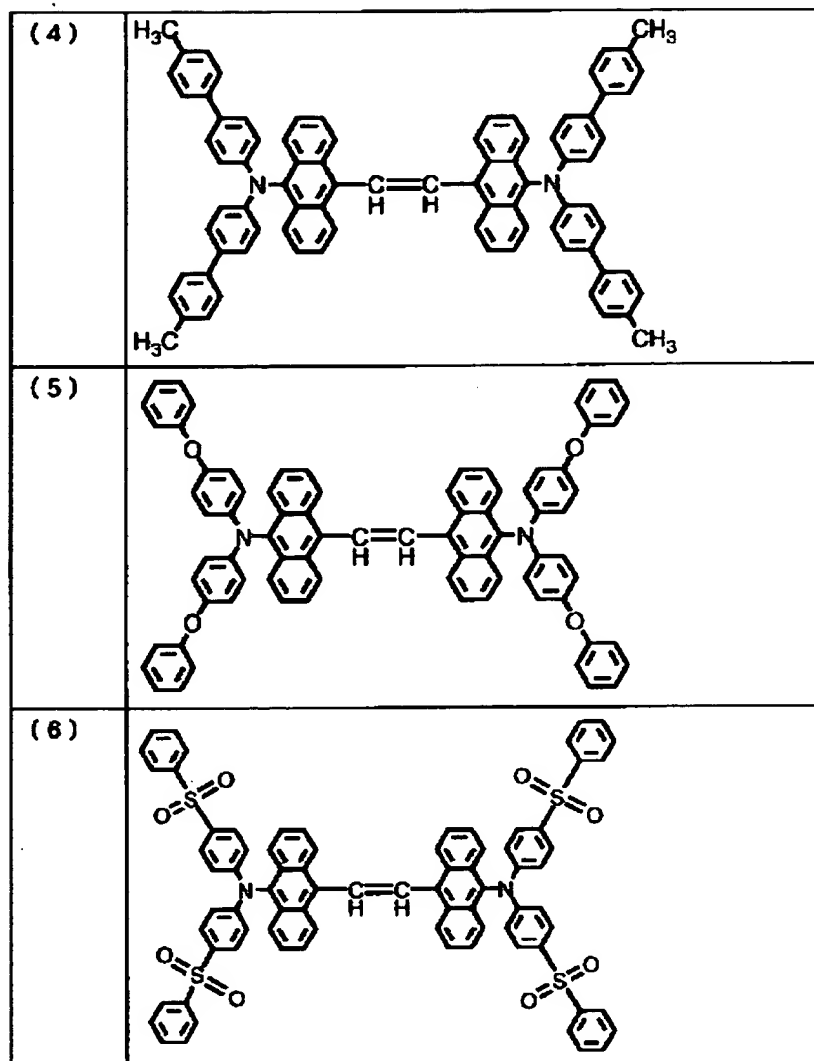
[-- A¹ -A⁴ and R¹ -R¹⁶ are the same as the above among a formula]

[0036]

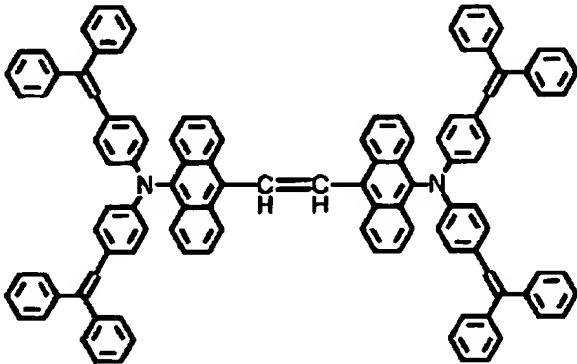
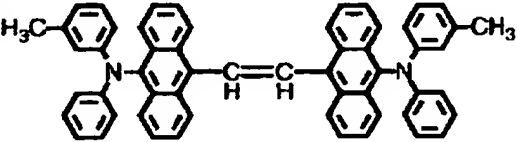
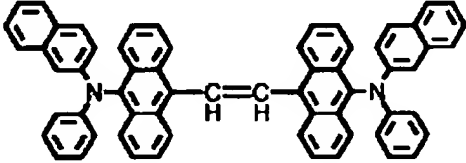
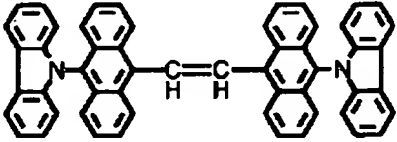
[Table 1]



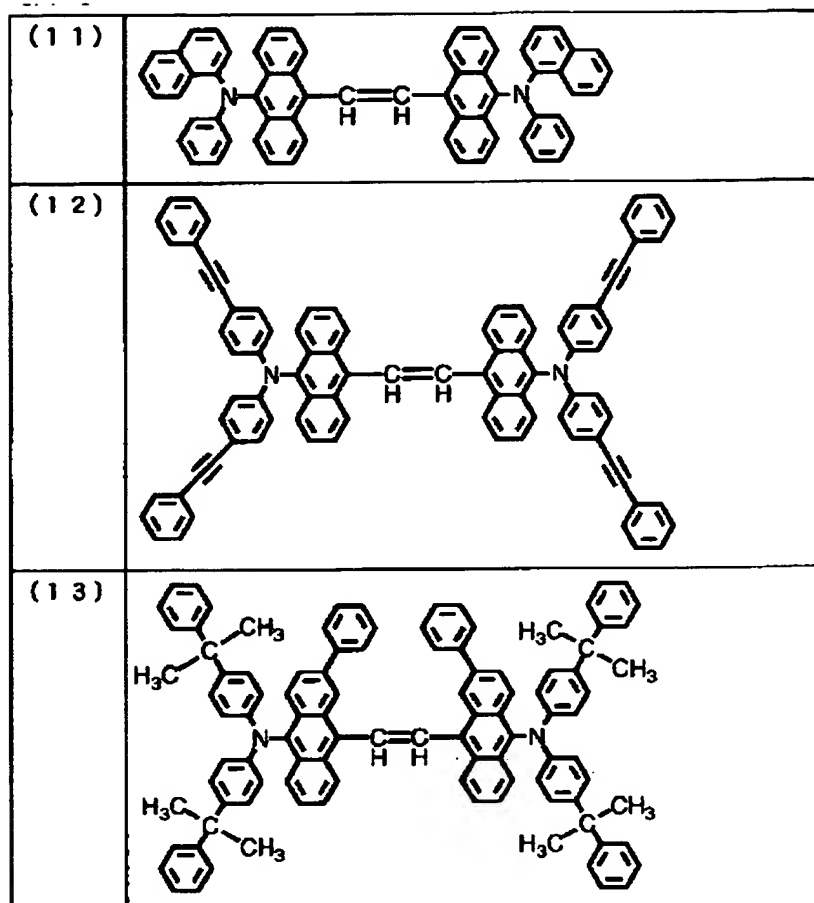
[0037]



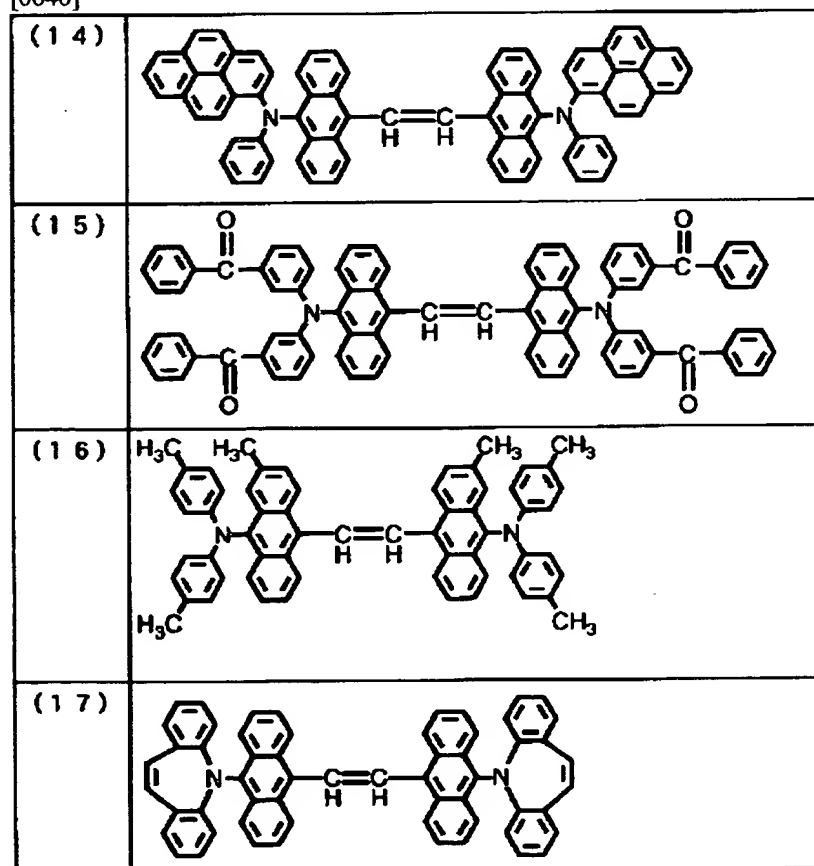
[0038]

(7)	
(8)	
(9)	
(10)	

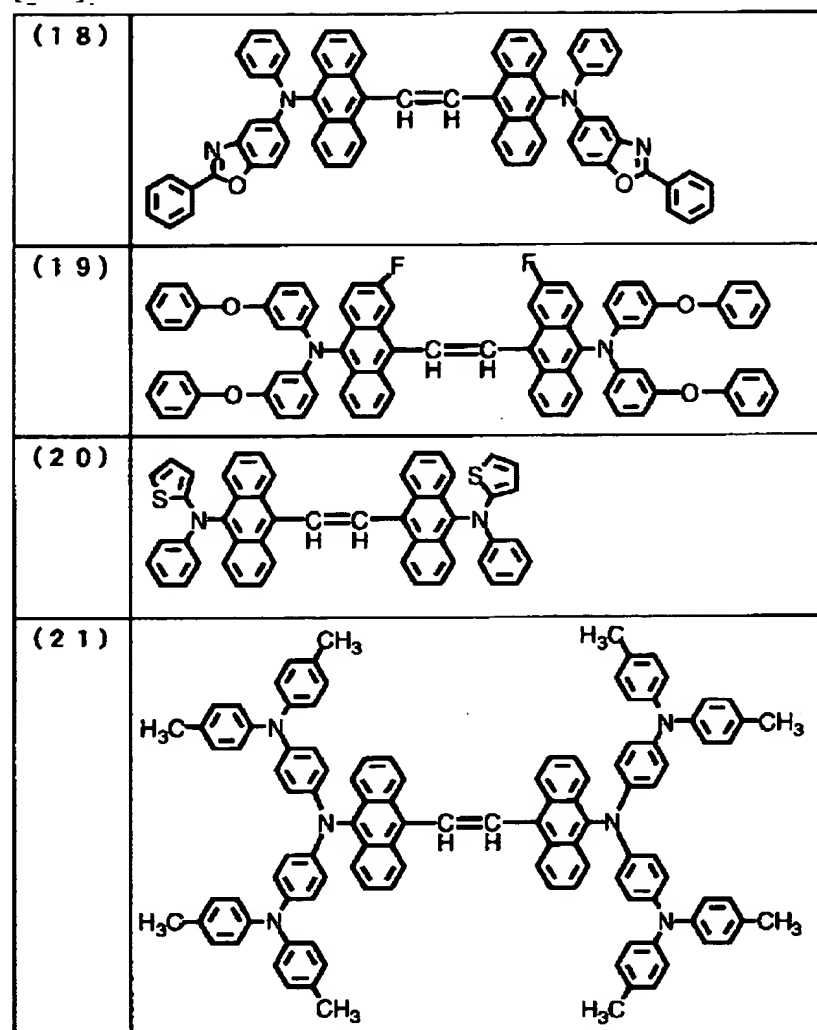
[0039]



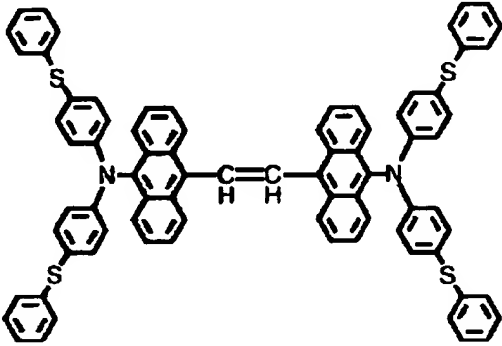
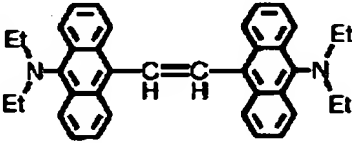
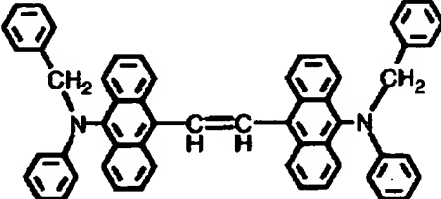
[0040]



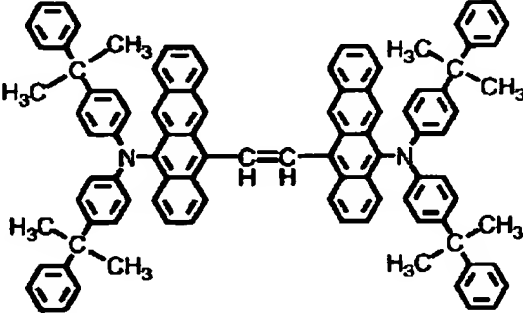
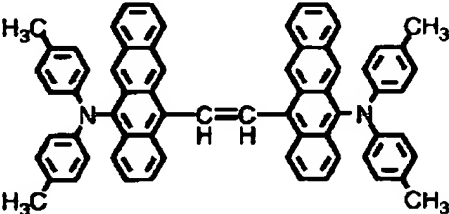
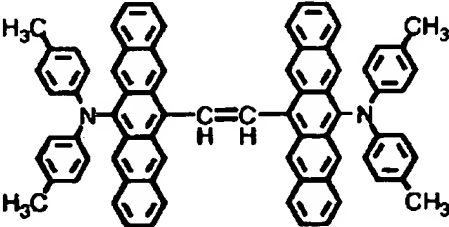
[0041]



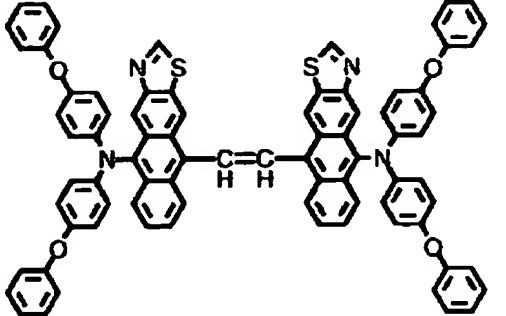
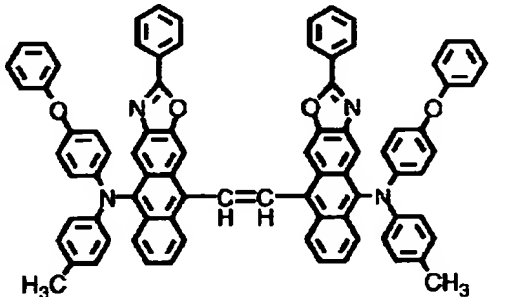
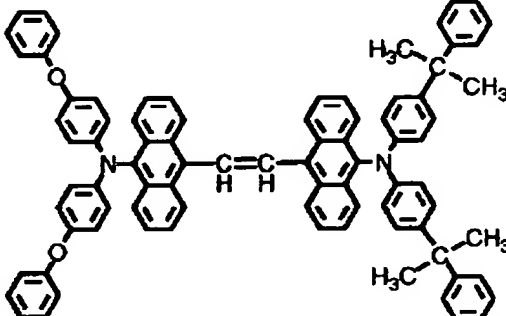
[0042]

(2 2)	
(2 3)	
(2 4)	

[0043]

(2 5)	
(2 6)	
(2 7)	

[0044]

(2 8)	
(2 9)	
(3 0)	

[0045]

(3 1)	
(3 2)	
(3 3)	
(3 4)	
(3 5)	

[0046]

(3 6)	
(3 7)	
(3 8)	

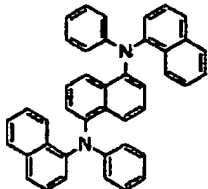
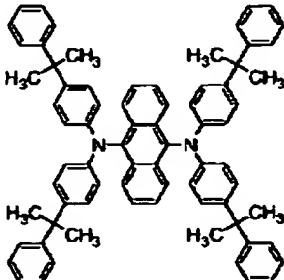
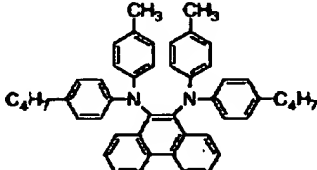
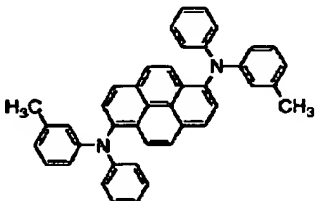
[0047] General formula [1] The compound expressed with - [5] has two olefin parts ($>C=C<$) in 1 molecule. By the geometrical isomer of this olefin part, although the compound expressed with a general formula [1] has the combination of a cis-object and a transformer object, the compounds of this invention may be the any and may be mixed.

[0048] An organic EL element is an element in which the monostromatic or the multilayer organic thin film was formed between an anode plate and cathode. In the case of the mold, the luminous layer is further prepared between an anode plate and cathode. A luminous layer contains luminescent material, and in order to make the electron poured in from the electron hole which was poured in from the anode plate in addition to it, or cathode convey to luminescent material, it may contain hole-injection material or electron-injection material. A multilayer type has the organic EL element which carried out the laminating with the multilayer composition of (an anode plate / hole-injection layer / luminous layer / cathode), (an anode plate / luminous layer / electron-injection layer / cathode), and (an anode plate / hole-injection layer / luminous layer / electron-injection layer / cathode). The compound shown by general formula [of this invention] [1] - [5] is a compound which has strong fluorescence in a solid state, and since it excels in electroluminescence nature, it can be used within a luminous layer as a luminescent material. Moreover, the optimal selection of high luminous efficiency and luminescence wavelength is possible for the compound of general formula [1] - [5] by doping at rate optimal in a luminous layer as a doping material in a luminous layer. Moreover, since the compound of general formula [1] - [5] can convey carriers, such as an electron hole or an electron, it can also be used for the hole-injection layer or electron-injection layer of an organic EL element.

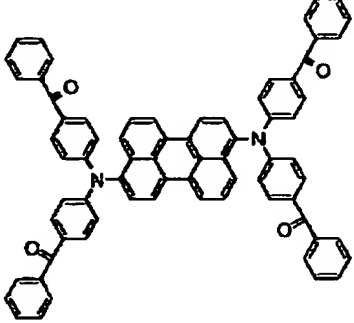
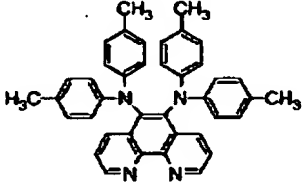
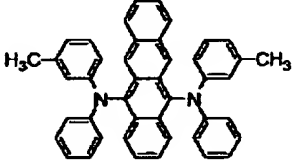
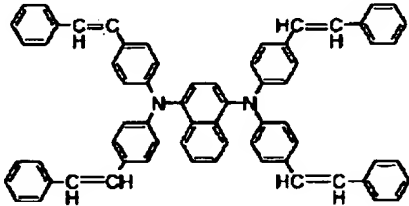
[0049] The compound of general formula [1] - [5] can be used for the host material of a luminous layer as a doping material (guest material), and an organic EL element with high luminescence brightness can also be obtained. General formula [1] As for the compound of - [5], it is desirable in a luminous layer to contain to host material in 0.001 % of the weight - 50% of the weight of the range, and 0.01 more % of the weight - 10% of the weight of its range is effective for it.

[0050] General formula [1] as a host material which can be used combining with the compound of - [5] A quinoline metal complex, an OKISA diazole, a benzothiazole metal complex, A benzo oxazole metal complex, a benzimidazole metal complex, a triazole, an imidazole, an oxazole, an OKISA diazole, a stilbene, a butadiene, A benzidine type triphenylamine, a styryl amine type triphenylamine, diamine type triphenylamine full -- me -- a non and diamino anthracene type triphenylamine -- A diamino phenanthrene type triphenylamine, an anthra quinodimethan, Diphenokquinone, thiadiazole, a tetrazole, a perylene tetrapod carboxylic acid, There are polymeric materials of conductive polymers, such as deflection ORENIRIDEN methane, an anthra quinodimethan, triphenylene, anthrones, etc. those derivatives and a polyvinyl carbazole, and polysilane, etc. Although concretely illustrated to Table 2 below, this invention is not limited to the following examples of representation.

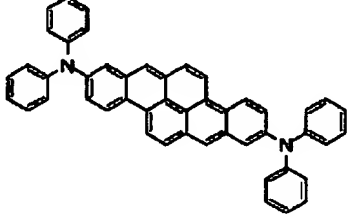
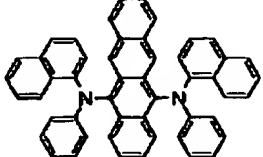
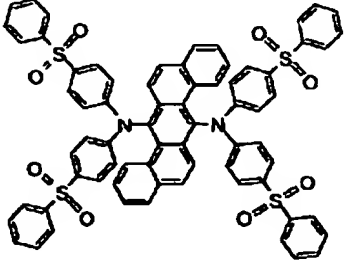
[0051]
[Table 2]

A - 1	
A - 2	
A - 3	
A - 4	

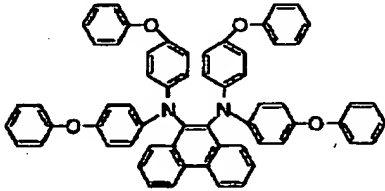
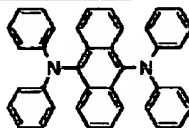
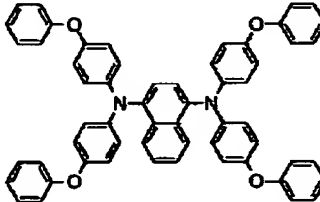
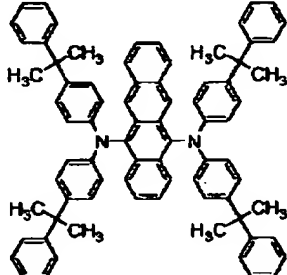
[0052]

A - 5	
A - 6	
A - 7	
A - 8	

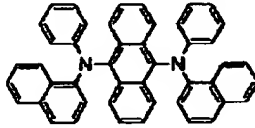
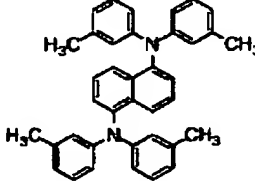
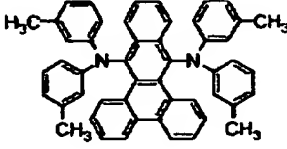
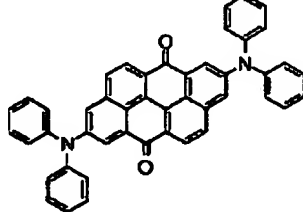
[0053]

A - 9	
A - 10	
A - 11	

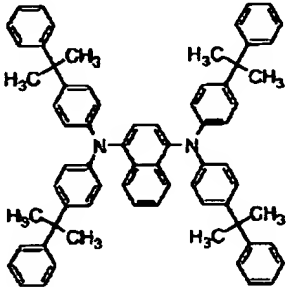
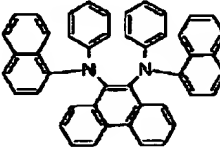
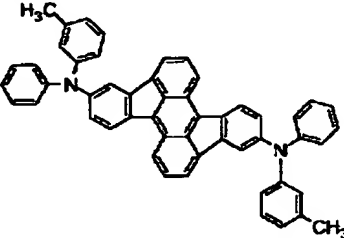
[0054]

A - 1 2	
A - 1 3	
A - 1 4	
A - 1 5	

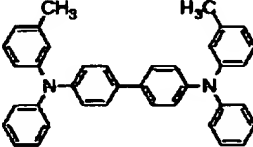
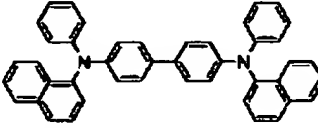
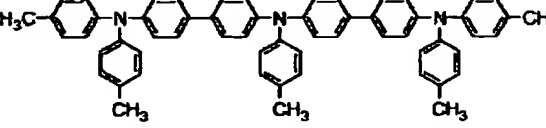
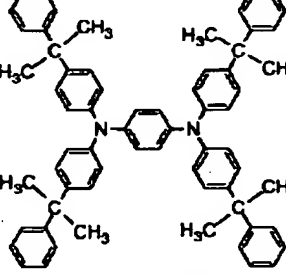
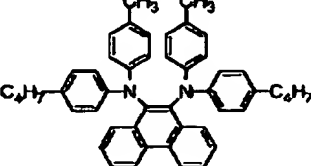
[0055]

A - 1 6	
A - 1 7	
A - 1 8	
A - 1 9	

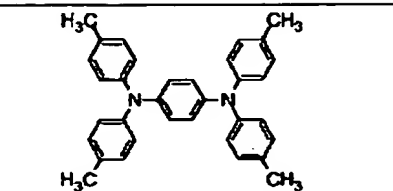
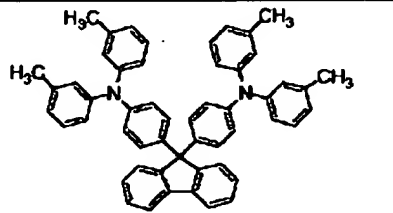
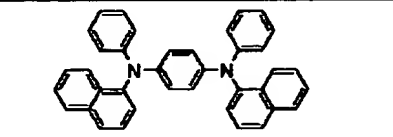
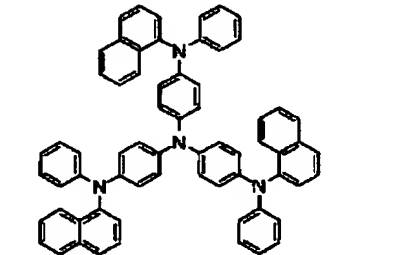
[0056]

A - 2 0	
A - 2 1	
A - 2 2	

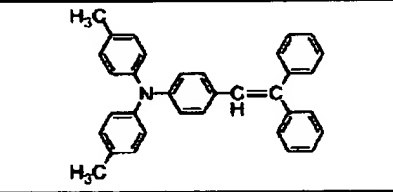
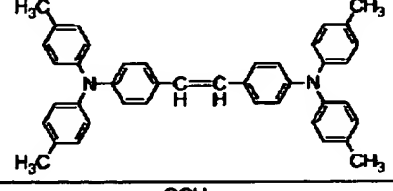
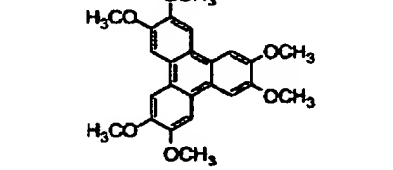
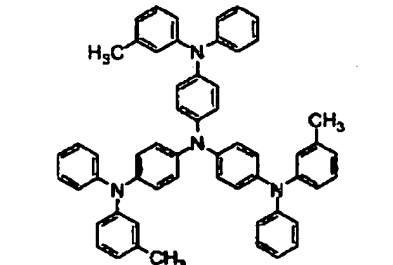
[0057]

A - 2 3	
A - 2 4	
A - 2 5	
A - 2 6	
A - 2 7	

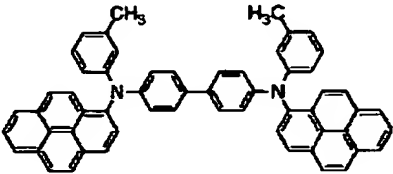
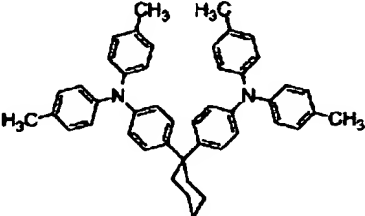
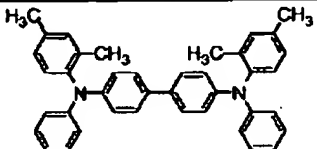
[0058]

A - 2 8	
A - 2 9	
A - 3 0	
A - 3 1	

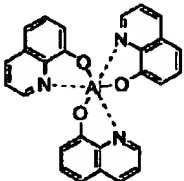
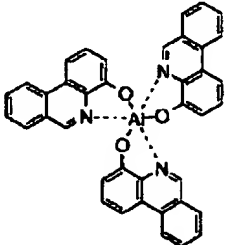
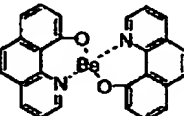
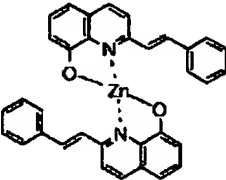
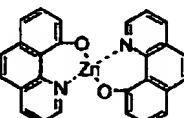
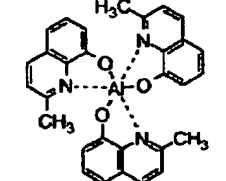
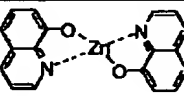
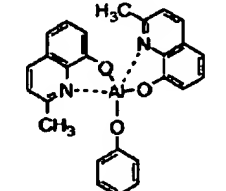
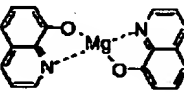
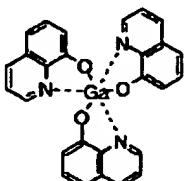
[0059]

A - 3 2	
A - 3 3	
A - 3 4	
A - 3 5	

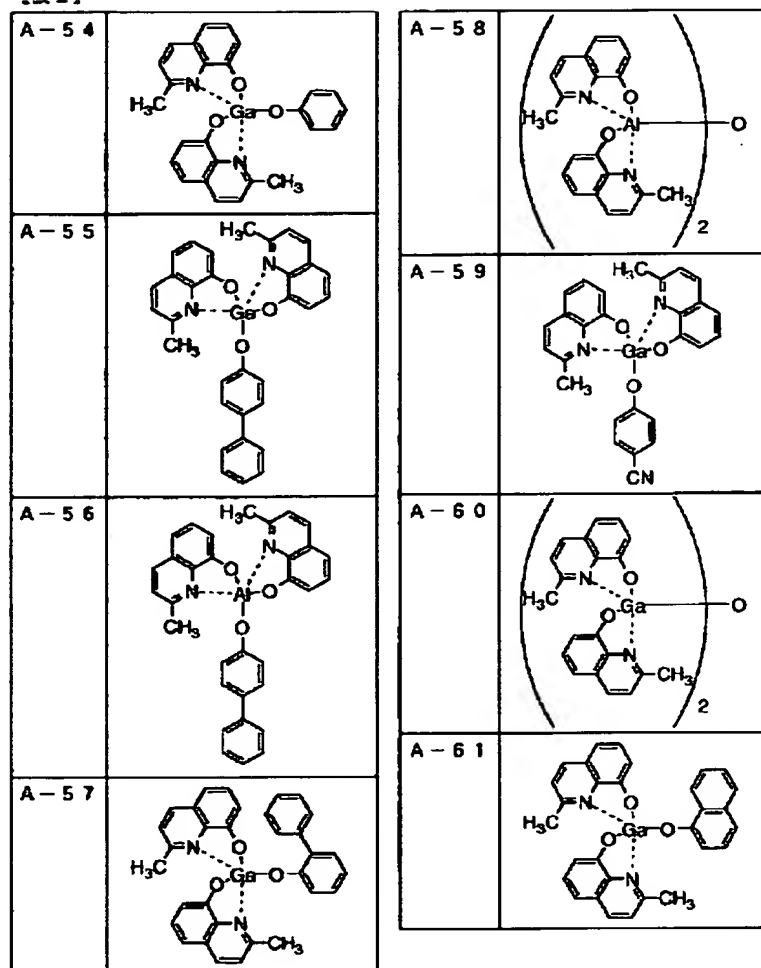
[0060]

A-36	銅フタロシアニン
A-37	銅ナフタロシアニン
A-38	塩化インジウムフタロシアニン
A-39	塩化アルミニウムフタロシアニン
A-40	ジクロロシリコンフタロシアニン
A-41	
A-42	
A-43	

[0061]

A-44		A-50	
A-45		A-51	
A-46		A-52	
A-47		A-53	
A-48			
A-49			

[0062]



[0063]

A - 6 2	
A - 6 3	
A - 6 4	
A - 6 5	
A - 6 6	

[0064]

A - 6 7	
A - 6 8	
A - 6 9	
A - 7 0	
A - 7 1	

[0065] General formula [1] It also becomes possible to change the luminescent color with - [5] using the further doping material. General formula [1] as a doping material used with - [5] An anthracene, naphthalene, a phenanthrene, a pyrene, a tetracene, A

coronene, a chrysene, a fluorescein, a perylene, a phtalo perylene, Non [naphthalo perylene and peri non, / phtalo peri non, / naphthalo peri] A diphenyl butadiene, a tetrapod phenyl butadiene, a coumarin, an OKISA diazole, Aldazine, screw benzo KISAZORIN, screw styryl, a pyrazine, a cyclopentadiene, A quinoline metal complex, an amino quinoline metal complex, an imine, a diphenylethylene, Although there are those derivatives, such as a vinyl anthracene, a diamino carbazole, a pyran, thiopyran, poly methine, merocyanine, an imidazole chelation oxy-NOIDO compound, a Quinacridone, and rubrene, it is not limited to these.

[0066] In addition to luminescent material and doping material, if there is need, hole-injection material and electron-injection material can also be used for a luminous layer.

[0067] An organic EL element can prevent the fall of the brightness by quenching, or a life by making it multilayer structure. Moreover, if there is need, two or more kinds can also be used combining luminescent material, doping material, and the hole-injection material and electron-injection material that performs carrier pouring. Moreover, a hole-injection layer, a luminous layer, and an electron-injection layer may be formed of the lamination more than a bilayer, respectively, an electron hole or an electron is efficiently poured in from an electrode, and the element structure conveyed in a layer is chosen.

[0068] A thing with a bigger work function than 4eV is suitable for a conductive material used for the anode plate of an organic EL element, and, as for metal oxide, such as tin oxide called those alloys and an ITO substrate, and a NESA substrate, indium oxide, etc., such as carbon, aluminum, vanadium, iron, cobalt, nickel, a tungsten, silver, gold, platinum, and palladium, and a further, organic conductive resin, such as the poly thiophene and polypyrrole, is used. A thing with a work function smaller than 4eV is suitable for a conductive material used for cathode, and those alloys, such as magnesium, calcium, tin, lead, titanium, an yttrium, a lithium, a ruthenium, and manganese, are used. As an alloy, although magnesium/silver, magnesium/indium, a lithium/aluminum, etc. are mentioned as an example of representation, it is not limited to these. The ratio of an alloy is controlled by the temperature of heating, atmosphere, and the degree of vacuum, and a suitable ratio is chosen. As long as an anode plate and cathode have the need, they may be formed of the lamination more than a bilayer.

[0069] In an organic EL element, in order to make light emit efficiently, at least one side has a transparent enough desirable thing in the luminescence wavelength field of an element. Moreover, it is desirable for a substrate to be also transparent. A transparent electrode uses the above-mentioned conductive material, and it sets it up so that a predetermined translucency may be secured by methods, such as vacuum evaporation and sputtering. As for the electrode of a luminescence side, it is desirable to make a light transmittance 10% or more. Although a substrate has mechanical and thermal intensity, and it is not limited if transparent, if it illustrates, transparency resins, such as a glass substrate, a polyethylene board, a polyether ape phon board, and a polypropylene board, will be raised.

[0070] Formation of each class of the organic EL element concerning this invention can apply which method of the wet forming-membranes methods, such as the dry type forming-membranes methods, such as vacuum deposition and sputtering, and spin coating, dipping. Although especially thickness is not limited, it needs to set each class as suitable thickness. If thickness is too thick, in order to obtain a fixed optical output, big applied voltage will be needed and efficiency will become bad. If thickness is too thin, even if a pinhole etc. will occur and it will impress electric field, sufficient luminescence brightness is not obtained. The usual thickness has the still more desirable range of 0.2 micrometers from 10nm, although the range of 10 micrometers is suitable from 5nm.

[0071] The solvent may be any, although the material which forms each class is dissolved or distributed to suitable solvents, such as chloroform, a tetrahydrofuran, and a dioxane, in the case of the wet forming-membranes method and a thin film is formed. Moreover, also in which thin film, you may use a suitable resin and a suitable additive on a membrane formation disposition for pinhole prevention of a film etc. As such a resin, conductive resin, such as photoconductivity resins, such as insulating resins, such as polystyrene, a polycarbonate, a polyarylate, polyester, a polyamide, polyurethane, a polysulfone, a polymethylmethacrylate, poly methyl acrylate, and a cellulose, Polly N-vinylcarbazole, and polysilane, the poly thiophene, and polypyrrole, can be mentioned. Moreover, an antioxidant, an ultraviolet ray absorbent, a plasticizer, etc. can be mentioned as an additive.

[0072] The compound which has the capacity to pour in an electron hole, as a hole-injection material, has the hole-injection effect which was excellent to a luminous layer or luminescent material, and prevented movement into the electron-injection layer or electron-injection material of an exciton generated by the luminous layer, and was excellent in thin film organization potency is mentioned. Specifically A phthalocyanine system compound, a naphthalocyanine system compound, A porphyrin system compound, an OKISA diazole, a triazole, an imidazole, Imidazolone, imidazole thione, a pyrazoline, a pyrazolone, a tetrahydro imidazole, An oxazole, an OKISA diazole, a hydrazone, an acyl hydrazone, The poly aryl alkane, a stilbene, a butadiene, a benzidine type triphenylamine, a styryl amine type triphenylamine, a diamine type triphenylamine, etc., Although there are polymeric materials, such as those derivatives and a polyvinyl carbazole, polysilane, and a conductive polymer, etc., it is not limited to these.

[0073] The compound which has the capacity to pour in an electron, as an electron-injection material, has the electron-injection effect which was excellent to a luminous layer or luminescent material, and prevented movement into the hole-injection layer or hole-injection material of an exciton generated by the luminous layer, and was excellent in thin film organization potency is mentioned. for example, a quinoline metal complex, an OKISA diazole, a benzothiazole metal complex, a benzo oxazole metal complex, a benzimidazole metal complex, and full -- me -- non, although there are an anthra quinodimethan, diphenquinone, thiopyran dioxide, an OKISA diazole, thiadiazole, a tetrazole, a perylene tetrapod carboxylic acid, deflection ORENIRIDEN methane, an anthra quinodimethan, anthrones, etc. and those derivatives, it is not limited to these Moreover, the electronic

acceptance matter can be added into hole-injection material, the electron-donative matter can be added into electron-injection material, and sensitization can be carried out.

[0074] It is also possible to prepare a protective layer on the surface of an element, or to enclose a silicone oil etc., and to protect the whole element for the improvement of stability to the temperature of the organic EL element obtained by this invention, humidity, atmosphere, etc.

[0075]

[Example] Hereafter, this invention is further explained to a detail based on an example.

[0076] Synthetic method THF 100ml of a compound (1) is put into a flask, it cools by ice bus, and 12ml of titanium tetrachlorides is dropped. Then, 9-formyl-9'-(N and N'-screw (4-methylphenyl)) AMINO-anthracene 4g is supplied in a flask, and 8g of zinc powder is added little by little. After adding all, the flask was heated, and the reaction was performed for bottom 5 hours of a rotary flow. The precipitation which added water and was produced was filtered and collected after the reaction end. After precipitating by silica gel, sublimation refining of the column refining was carried out. Generation of a compound was checked by NMR, FD-MS, and IR. The IR-spectrum view of a compound (1) is shown in drawing 1.

[0077] On the glass plate with an ITO electrode washed example 1, they are N, N'-(3-methylphenyl)-N, and N'-diphenyl. - 1 and 1-biphenyl - Vacuum deposition of the 4 and 4-diamine (TPD) was carried out, and the hole-injection layer of 20nm of thickness was obtained. Subsequently, the vacuum evaporatio of the compound (1) was carried out, the luminous layer of 40nm of thickness was created, the vacuum evaporatio of the tris (8-hydroxyquinoline) aluminum complex (Alq3) was carried out, and the electron-injection layer of 30nm of thickness was obtained. The electrode of 100nm of thickness was formed with the alloy which moreover mixed silver with magnesium by 10:1, and the organic EL element was obtained. The hole-injection layer and the luminous layer were deposited under the conditions of a substrate temperature room temperature in the vacuum of 10⁻⁶Torr. As for this element, orange luminescence of luminescence brightness 100 cd/m², maximum luminescence brightness 20000 cd/m², and luminous efficiency 2.5 lm/W at the time of 5V was obtained by direct-current-voltage 5V. Next, 3mA/cm² 1/2 or more luminescence of initial brightness was held for 10000 hours or more as a result of life test which made this element emit light continuously with current density.

[0078] It changed to the compound (1) at two to example 38 luminous layer, and the organic EL element was produced by the same method as an example 1 except using the compound shown in Table 3. This element showed the luminescence property shown in Table 3.

[0079]

[Table 3]

[表 3]

実施例	化合物	5 V 発光輝度 (cd/m ²)	最大発光輝度 (cd/m ²)	最大発光効率 (lm/W)
2	(2)	130	13000	2.4
3	(3)	140	29000	2.6
4	(4)	120	25000	2.2
5	(5)	130	23000	2.8
6	(6)	120	23000	2.5
7	(7)	110	22000	2.3
8	(8)	130	19000	2.3
9	(9)	140	24000	2.4
10	(10)	150	19000	2.3
11	(11)	140	24000	2.9
12	(12)	150	18000	2.0
13	(13)	130	24000	2.1
14	(14)	180	23000	2.1
15	(15)	130	22000	1.8
16	(16)	160	22000	2.3
17	(17)	110	23000	2.4
18	(18)	190	22000	2.5
19	(19)	120	23000	2.3

[0080]

[表 3]

実施例	化合物	5 V 発光輝度 (cd/m ²)	最大発光輝度 (cd/m ²)	最大発光効率 (lm/W)
20	(20)	180	21000	2.5
21	(21)	140	19000	2.6
22	(22)	150	18000	2.2
23	(23)	130	24000	2.8
24	(24)	120	23000	2.5
25	(25)	130	19000	2.3
26	(26)	120	18000	2.2
27	(27)	110	24000	2.5
28	(28)	140	18000	2.9
29	(29)	130	23000	2.8
30	(30)	170	24000	2.2
31	(31)	140	19000	2.6
32	(32)	150	18000	2.2
33	(33)	130	24000	2.8
34	(34)	120	24000	2.5
35	(35)	130	23000	2.3
36	(36)	120	22000	2.2
37	(37)	110	22000	2.5
38	(38)	140	18000	2.9

[0081] Vacuum deposition of the compound (12) was carried out on the glass plate with an ITO electrode washed example 39, the luminous layer of 100nm of thickness was created, the electrode of the thickness of 150nm of thickness was formed on it with the alloy which mixed silver with magnesium by 10:1, and the organic EL element was obtained. A luminous layer and cathode were deposited under the conditions of a substrate temperature room temperature in the vacuum of 10⁻⁶Torr. As for this element, orange luminescence of luminescence brightness 30 cd/m², maximum luminescence brightness 1200 cd/m², and luminous efficiency 0.3 lm/W at the time of 5V was obtained by direct-current-voltage 5V. Next, 1/2 or more luminescence of initial brightness was held cm for 5000 hours or more as a result of life test which made this element emit light in succession with the current density of 2mA [3 /].

[0082] On the glass plate with an ITO electrode washed example 40, the vacuum evaporation of the compound (21) was carried out, the hole-injection layer of 80nm of thickness was created, subsequently, the vacuum evaporation of Alq3 was carried out, and the luminous layer of 20nm of thickness was obtained. The electrode of 100nm of thickness was formed with the alloy which moreover mixed silver with magnesium by 10:1, and the organic EL element was obtained. The hole-injection layer and the luminous layer were deposited under the conditions of a substrate temperature room temperature in the vacuum of 10⁻⁶Torr. As for this element, luminescence of luminescence brightness 80 cd/m², maximum luminescence brightness 8000 cd/m², and luminous efficiency 1.1 lm/W at the time of 5V was obtained by direct-current-voltage 5V. Next, 3mA/cm² 1/2 or more luminescence of initial brightness was held for 3000 hours or more as a result of life test which made this element emit light continuously with current density.

[0083] On the glass plate with an ITO electrode washed example 41, the vacuum evaporation of the TPD was carried out, the hole-injection layer of 50nm of thickness was produced, subsequently, the vacuum evaporation of Alq3 was carried out, and the luminous layer of 20nm of thickness was obtained. The vacuum evaporation of the compound (28) was carried out, the electron-injection layer of 60nm of thickness was created, the electrode of 100nm of thickness was formed on it with the alloy which mixed silver with magnesium by 10:1, and the organic EL element was obtained. The hole-injection layer and the luminous

layer were deposited under the conditions of a substrate temperature room temperature in the vacuum of 10⁻⁶Torr. As for this element, luminescence of luminescence brightness 100 cd/m², maximum luminescence brightness 6000 cd/m², and luminous efficiency 0.9 lm/W at the time of 5V was obtained by direct-current-voltage 5V. Next, 3mA/cm² 1/2 or more luminescence of initial brightness was held for 3000 hours or more as a result of life test which made this element emit light continuously with current density.

[0084] On the glass plate with an ITO electrode washed example 42, vacuum deposition of the TPD was carried out and the hole-injection layer of 20nm of thickness was obtained. Subsequently, N, N'-(4-methylphenyl)-N, and N' -(4-n-buthylphenyl)-Phenanthrene - The vacuum evaporation of the weight ratio ** of 100:1 was carried out for the compound (1) to 9 and 10-diamine, the luminous layer of 40nm of thickness was created, the vacuum evaporation of Alq3 was carried out, and the electron-injection layer of 10nm of thickness was obtained. The electrode of 100nm of thickness was formed with the alloy which moreover mixed silver with magnesium by 10:1, and the organic EL element was obtained. The hole-injection layer and the luminous layer were deposited under the conditions of a substrate temperature room temperature in the vacuum of 10⁻⁶Torr. As for this element, yellow luminescence of luminescence brightness 150 cd/m², maximum luminescence brightness 14000 cd/m², and luminous efficiency 2.8 lm/W at the time of 5V was obtained by direct-current-voltage 5V. Next, 3mA/cm² 1/2 or more luminescence of initial brightness was held for 10000 hours or more as a result of life test which made this element emit light continuously with current density.

[0085] On the glass plate with an ITO electrode washed example 43, vacuum deposition of 4, 4', and the 4"-tris [N-(3-methylphenyl)-N-phenylamino] triphenylamine was carried out, and the hole-injection layer of 40nm of thickness was obtained. Subsequently, vacuum deposition of the 4 and 4' screw [-] [N-(1-naphthyl)-N-phenylamino] biphenyl (alpha-NPD) was carried out, and the second hole-injection layer of 10nm of thickness was obtained. Furthermore, vacuum deposition of the compound (1) was carried out, the luminous layer of 30nm of thickness was created, vacuum deposition of the screw (2-methyl-8-hydroxyquinolate) (1-phenolate) gallium complex was carried out further, the electron-injection layer of 30nm of thickness was created, the electrode of 150nm of thickness was formed on it with the alloy which mixed aluminum and the lithium by 25:1, and the organic EL element was obtained. The hole-injection layer and the luminous layer were deposited under the conditions of a substrate temperature room temperature in the vacuum of 10⁻⁶Torr. As for this element, orange luminescence of the luminescence brightness 210 (cd/m²), the maximum luminescence brightness 29000 (cd/m²), and luminous efficiency 2.8 (lm/W) was obtained by direct-current-voltage 5V.

[0086] It changed to the compound (1) at 44 to example 90 luminous layer, and the organic EL element was produced by the same method as an example 1 except using the compound shown in Table 4. This element showed the luminescence property shown in Table 4.

[0087]

[Table 4]

【表4】

実施例	化合物	5 V発光輝度 (cd/m ²)	最大発光輝度 (cd/m ²)	最大発光効率 (lm/W)
44	(2)	190	29000	3.6
45	(3)	230	34000	2.8
46	(4)	170	29000	2.7
47	(5)	240	27000	3.4
48	(6)	150	26000	3.3
49	(7)	160	34000	3.2
50	(8)	230	28000	2.2
51	(9)	230	33000	2.8
52	(10)	180	29000	3.5
53	(11)	190	28000	3.3
54	(12)	220	34000	3.2
55	(13)	230	29000	2.5
56	(14)	180	27000	3.4
57	(15)	260	26000	3.0
58	(16)	210	26000	3.1
59	(17)	190	23000	2.9
60	(18)	160	32000	3.4
71	(19)	230	27000	3.3
72	(20)	230	29000	3.2

[0088]

【表4】

実施例	化合物	5 V発光輝度 (cd/m ²)	最大発光輝度 (cd/m ²)	最大発光効率 (lm/W)
73	(21)	180	33000	2.5
74	(22)	220	28000	3.4
75	(23)	190	27000	3.0
76	(24)	240	25000	3.1
77	(25)	250	28000	3.4
78	(26)	260	32000	2.8
79	(27)	220	33000	2.9
80	(28)	230	28000	3.3
81	(29)	190	30000	3.2
82	(30)	260	31000	3.2
83	(31)	140	29000	3.4
84	(32)	250	38000	3.2
85	(33)	260	34000	3.7
86	(34)	320	32000	3.5
87	(35)	230	37000	3.3
88	(36)	220	34000	3.2
89	(37)	240	32000	3.1
90	(38)	250	38000	2.9

[0089] On the glass plate with an ITO electrode washed example 91, a compound (3), Alq3 and TPD, and polycarbonate resin (PC-A) were dissolved in the tetrahydrofuran by the weight ratio of 3:2:3:8, and the luminous layer of 100nm of thickness was obtained by the spin coating method. The electrode of 150nm of thickness was formed with the alloy which moreover mixed silver with magnesium by 10:1, and the organic EL element was obtained. As for this element, luminescence of luminescence brightness 12 cd/m², maximum luminescence brightness 3100 cd/m², and luminous efficiency 0.5 lm/W at the time of 5V was obtained by direct-current-voltage 5V. Next, 3mA/cm² 1/2 or more luminescence of initial brightness was held for 3000 hours or more as a result of life test which made this element emit light continuously with current density.

[0090] On the glass plate with an ITO electrode washed example 92, vacuum deposition of alpha-NPD was carried out, and the hole-injection layer of 30nm of thickness was obtained. Subsequently, the vacuum evaporations of the compound (1) as the screw (2-methyl-8-hydroxyquinolate) (1-phenolate) gallium complex and doping material as a host material is carried out by the weight ratio of 50:1. the luminous layer of 30nm of thickness -- creating -- further -- a vacuum deposition method --

[2-(4-tert-butylphenyl)-5-(biphenyl)- the electron-injection layer of 20nm of thickness of 1, 3, and 4-OKISA diazole] was obtained The electrode of 150nm of thickness was formed with the alloy which moreover mixed silver with magnesium by 10:1, and the organic EL element was obtained. A hole-injection layer, a luminous layer, an electron-injection layer, and cathode were deposited under the conditions of a substrate temperature room temperature in the vacuum of 10⁻⁶Torr. As for this element, yellow luminescence of luminescence brightness 330 cd/m², maximum luminescence brightness 53000 cd/m², and luminous efficiency 4.3 lm/W at the time of 5V was obtained by direct-current-voltage 5V. Next, 3mA/cm² 1/2 or more luminescence of initial brightness was held for 10000 hours or more as a result of life test which made this element emit light continuously with current density.

[0091] The organic EL element was produced by the same method as an example 24 except using the compound shown as host material and a doping material in Table 5 for 93 to example 103 luminous layer. This element showed the luminescence property shown in Table 5.

[0092]

[Table 5]

【表5】

実施例	ホスト 化合物	ドーピン グ化合物	5 V 発光輝度 (cd/m ²)	最大発光輝度 (cd/m ²)	最大発光効率 (lm/W)
93	A-2	(2)	220	38000	3.7
94	A-7	(3)	340	33000	3.4
95	A-10	(6)	310	34000	3.3
96	A-13	(8)	340	31000	3.2
97	A-15	(9)	320	27000	3.6
98	A-22	(12)	250	38000	3.6
99	A-24	(14)	300	31000	3.7
100	A-33	(15)	310	34000	3.4
101	A-44	(19)	240	37000	3.5
102	A-54	(21)	320	34000	3.2
103	A-63	(22)	290	33000	3.3

[0093] The organic EL element of this invention attains improvement in luminous efficiency and luminescence brightness, and reinforcement, and does not limit the element production methods used collectively, such as luminescent material, doping material, hole-injection material, electron-injection material, a sensitizer, a resin, and an electrode material.

[Effect of the Invention] By this invention, compared with the former, it is high luminous efficiency and high brightness in the wavelength field of yellow - red, and the long lasting organic EL element was able to be obtained.

[Translation done.]